Deformation and Fracture of Ruthenium Aluminide

David Johnson, Purdue University, DMR Award#0076219

Single Crystals and in-situ Eutectics

- Crystal growth techniques to grow Ruthenium Aluminide (RuAl) with a melting point of 2038°C have been developed.
- Deformation and fracture experiments as a function of composition and temperature on RuAl-base alloys are in progress.
- The RuAl-(Ru,Mo) eutectic alloys have a good room temperature fracture toughness near 37 MPa√m.
- Results are important in the design of multiphase high temperature structural materials.

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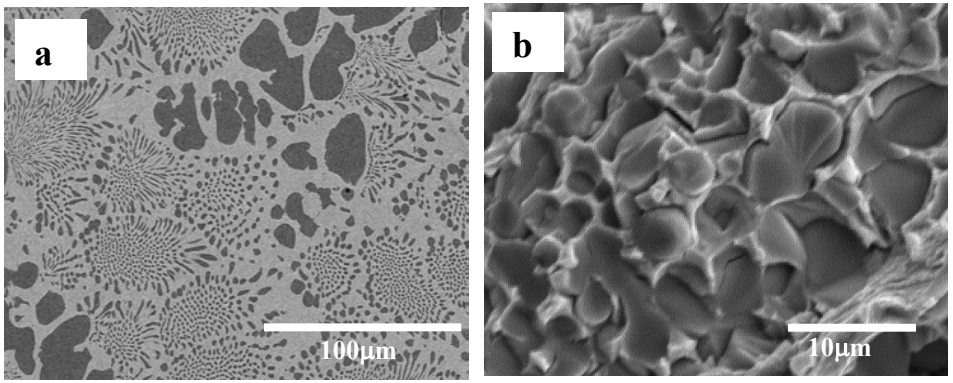
S. Rosset, R. Cefalu, L. Varner, and D. Johnson, "Crystal growth of RuAl-base alloys," in *High-Temperature Ordered Intermetallic Alloys IX*, J H. Schneibel *et al.* eds, Mat. Res. Soc. Symp., vol. 646 (2001) pp. N5.28.1-6.

T.D. Reynolds and D.R. Johnson, "Microstructure and mechanical properties of Ru-Al-Mo alloys," *Intermetallics* (2003; in press).

Table 1: Fracture toughness values and phase fractions for a Ru-20Al-25Mo alloy produced by arc-melting and cold crucible Czochralski (CZ) techniques.

	Fracture Toughness K_Q (MPa√m)	VolumeFractions (%) RuAl	(Ru,Mo)
Pulled (CZ)	36.9	34	66
Arc-melted	27.7	45	55



Images from a scanning electron microscope of (a) the microstructure of a Ru-20Al-25Mo ingot grown by a cold crucible Czochralski technique and (b) the fracture surface after 4-point bend tests.

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Training and Outreach

•Two graduate students, Sebastien Rosset and Todd Reynolds, have participated in this research. Mr. Rosset has completed his MS degree (Dec. 2001). Todd Reynolds is currently pursuing his doctorate.

• Provided training for 3 undergraduate students: Rachel Cefalu as part of the GE Fund "Faculty for the Future: Engineering and Science" scholarship, and Katie Wells and Lou Varner as part of an NSF-REU program at Purdue.

•International research experience - Todd Reynolds spent the summer of 2003 conducting research at Kyoto University, Japan as part of an NSF summer research program.

Todd Reynolds prepares arc-melted buttons of RuAl-Mo for further processing.